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ROGERS Booster

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A MAGAZINE DEVOTED TO THE INTERESTS OF RADIO—TV TECHNICIANS IN CANADA

INDUSTRY NEWS

New CBC Satellite — The CBC recently completed plans for the installation of a satellite TV station in the Kenora - Rainy River area. Construction will start this year.

More Power for VOCM — Newfoundland's first privately-owned station in St. John's which has been on the air for 22 years, has increased its power from 1,000 to 10,000 watts.

Canadian Briefs — During the past five years over 50 new types of electronic components have gone into production in Canada . . . There are now 40% more electronic component manufacturers in Canada than there were five years ago . . . Of the electronic equipment manufactured in Canada, the Canadian content is about 80% but it is estimated that, of the overall use of components, 50% is imported . . . Annual sales volume of Canadian electronic components manufacturers is better than $50 million.

Sputnik TV — If one can believe a report in a Soviet magazine, construction may now be underway to extend Russian TV to two billion people in Europe, Asia, Africa and Australia. The relay satellite is planned to be set into orbit at 22,350 miles where it will move at the same speed as the earth; which means that it will remain at one spot in relation to the earth beneath. It is claimed that this method will be far cheaper than building thousands of TV stations even if each relay satellite lasts for only one year.

Front Cover

Two attractive visitors examine the wide range of electronic tubes and components displayed at the Rogers booth at the recent I.R.E. Canadian Convention held in Toronto, October 8th, 9th, 10th.

Back Cover

One of the most versatile tubes on the market today is the Rogers 5AR4 Special Quality rectifier illustrated on the back cover. The list below shows the many tubes it is capable of replacing:

5AS4, 5AS4A — Direct replacement up to 250 mA. 5AR4 indirectly heated. Slower warm-up.

5AW4 — Direct replacement. 5AR4 indirectly heated. Slower warm-up.

5AX4, 5AX4GT — Direct replacement. 5AR4 indirectly heated. Slower warm-up.

5AZ4 — Change socket to octal. 5AR4 indirectly heated. Slower warm-up.

5R4, 5R4GY, 5R4GYA, 5T4 — Direct replacement up to 550 volts r.m.s. in. 5AR4 indirectly heated. Slower warm-up.

5U4, 5U4G — Direct replacement. 5AR4 indirectly heated. Slower warm-up.

5U4GA, 5U4GB — Direct replacement up to 250 mA. 5AR4 indirectly heated. Slower warm-up.

5V4, 5V4G — Direct replacement.

5W4, 5W4G, 5W4GT/G — Direct replacement.

5X3 — Direct replacement up to 550 volts r.m.s. in. Slower warm-up.

5X4, 5X4G, 5X4GA — Join pin 7 and 2, 3 and 4, 5 and 6. 5AR4 indirectly heated. Slower warm-up.

5Y3, 5Y3G, 5Y3GA, 5Y3GT, 5Y3GTA — Direct replacement. 5AR4 indirectly heated. Slower warm-up.

5Y4, 5Y4G, 5Y4GA — Join pin 7 and 2, 3 and 4, 5 and 6. 5AR4 indirectly heated. Slower warm-up.

5Z3 — Change socket to octal. 5AR4 indirectly heated. Slower warm-up.

5Z4 — Direct replacement.

83V — Change socket to octal. Slower warm-up.

80 — Change socket to octal. Slower warm-up.

Protecting Electronic Equipment

Current surges cause more damage and shorten the life of electronic equipment to a greater extent than is generally known. For example, even in a completely normal TV set, the current during the first second of operation may be more than twice normal. This fact is recognized in the design of some industrial equipment that is never completely shut down.

This method is not so readily adaptable to domestic equipment and so several other approaches are being made to the problem. Typical examples are resistors, thermistors, relays and controlled warm-up heater tubes.

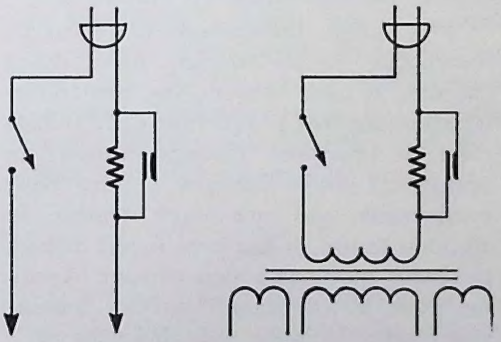
Relays are commonly used to delay the application of plate and screen voltages so that there is at least a partial warm-up of cathodes before the tubes take over their loads. This reduces cathode-stripping but does not protect capacitors and rectifiers that still receive their surges when the relay closes.

Resistors, or better still thermistors, will help reduce the current surges when placed in series with the line. Thermistors have a negative temperature coefficient, their initial resistance being high and falling off as they warm up. They have been applied very successfully in some equipment but have two disadvantages: there is always some resistance left in the circuit and the warm-up period increases with age. Because of the latter, a circuit such as an oscillator may remain dead for a long time. Nevertheless, they have their merits in that the presence of some resistance will tend to protect other components if one should short-circuit.

When Should They Be Installed? — The installation of protective devices or the change or value of any component in an electronic instrument must not be done indiscriminantly since design cannot always be altered with impunity.

For example, the introduction of a resistive device may protect some components and yet affect adversely such circuits as limiters and AGC. Thus, it is somewhat of a problem to protect equipment that has not been designed to include such features.

The Surgistor — The surgistor is one answer to this problem and is relatively simple. It consists of a resistive element shunted by a pair of contacts, the latter being open when the element is cold. One contact is mounted on a bi-metallic element



and, after about 10 seconds, enough heat is generated by the resistor to cause the contacts to close.

Of course, once the resistor is shorted out, it cools off but the current that then flows through the bi-metallic armature produces enough heat to maintain contact.

The accompanying illustration shows

(Cont'd on page 5)

Design Trends in TV Tuners

A TV receiver can be no better than its front end. This fact was learned very early in the game by some manufacturers who tried to corner the market with a cheaper set. If they remained in business at all it was because they improved their sets – usually a redesign of the front end. However, even the best of tuners have had their drawbacks.

As we know, a triode contributes less electrical noise than a tetrode or pentode and would be desirable in a TV tuner. Unfortunately, the plate-grid capacitance seriously reduces gain at these frequencies unless it can be neutralized.

One solution to this problem was the cascode amplifier. In this circuit the input triode is usually a grounded-cathode amplifier that feeds into a grounded-grid stage. Since the signal is fed to the cathode of the second triode, the grounded-grid isolates the input from the output.

Nevertheless, the cascode tuner has its drawbacks. In its simplest form, direct coupling is used between the two triodes which means that a fairly high plate voltage must be provided. Circuits designed to operate at lower voltages require more components and are more costly. In addition to this, it has been found difficult to obtain good agc action without increasing noise at low signal levels or running into cross-modulation at high levels.

The Neutralized Triode – An r-f amplifier using a single neutralized triode avoids these drawbacks and still gives good gain and a low noise level. One typical model requires only 135 volts plate supply which makes it suitable for a transformerless set.

The circuit of such an amplifier is shown in the accompanying illustration. Here T1 is a balun that matches the 300-ohm line to the 75-ohm input of the amplifier. The cores are ferrite.

L1-C1 and L2-L3 compose a band-rejection filter that rejects all frequencies between 41 and 46 mc. Note that L2 is adjustable and it is this inductor that is varied to increase rejection for one particular frequency.

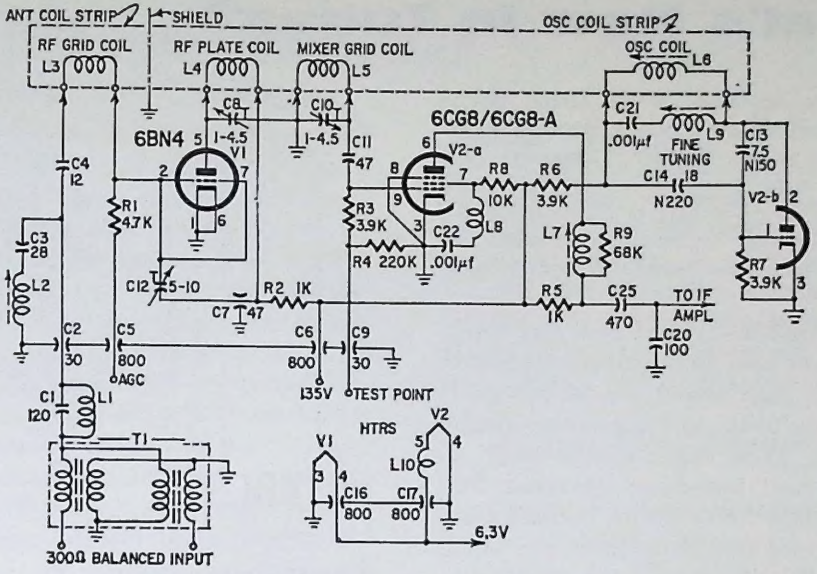
C4 is a d-c blocking capacitor that isolates the agc voltage. Also, since it is in series with the signal path, its relatively high reactance at lower frequencies assists in the rejection of interference.

L3, in conjunction with C2, C4 and the input capacitance of the tube, forms a series-resonant circuit and, since the input capacitance is small compared to the others, the greatest part of the signal voltage appears between grid and cathode. Thus a voltage gain is obtained without the use of a transformer.

Plate coil L4 is in parallel with trimmer C8 and the output capacitance of the triode. The trimmer is usually adjusted for channel 10 and the plate coils for all other channels are designed to tune properly with this established capacitance.

The Neutralizing Circuit – It will be observed that R2 is a 1000-ohm resistor in the triode plate circuit, bypassed by C7. At first, C7 would appear as a decoupling capacitor until we note its very small size. Because it is only 47 mmfd, it leaves a little of the signal voltage on the lead running to C12. This voltage is 180 degress out of phase with the voltage fed back to the grid due to plate-grid capacitance.

This, of course, is the essential feature in the new design. By neutralizing the



feedback voltage in the tube, we prevent self-oscillation in the triode. The two opposing voltages are made equal by adjusting trimmer C12.

While neutralization seems like an obvious way to solve all triode problems, it has not always been so simple a matter to obtain effective neutralization on all frequencies. The secret lies in the 6BN4 or the further improved Rogers 2/6ER5 that have been designed specifically for low plate-grid capacitance. Lead inductance is also reduced by the use of two leads to both grid and cathode; lead inductance being another factor that makes it difficult to neutralize satisfactorily for a band of frequencies.

That is also the reason why C7 is made a feed-through capacitor since otherwise inductance common to both plate and grid circuits might be introduced.

The Local Oscillator — The local oscillator (a modified version of a grounded-cathode Colpitts circuit) uses a variable inductor for fine tuning which is said to improve the stability of the circuit. By varying the inductance, the capacitance of the circuit can remain fixed and large enough to make changes in tube characteristics, and their effect on oscillator frequency, negligible.

(Cont'd from page 3)

how the surgistor is installed in sets using either transformers or series strings. In most cases, initial surges are limited to 25% of normal which helps to prevent cathode stripping and reduces the shock to rectifiers. Field tests indicate that the use of surge protection more than triples tube life.

Application — Existing receivers that do not have any protective device can be modified to include a surgistor as shown. Where a set already has a thermistor, for example, the hot resistance has already been allowed for by the manufacturer. Therefore, a fixed resistor equal to the hot resistance of the thermistor should be included in the circuit. Existing relays that merely delay the application of B+ may be left in the circuit.

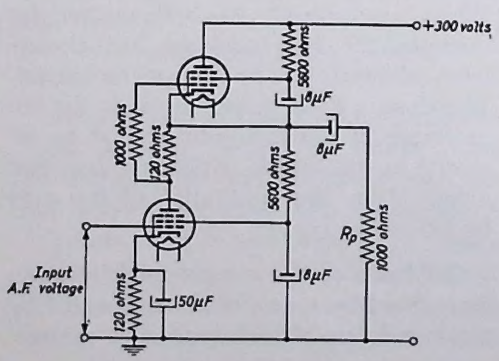
Call-backs due to component failure can be reduced by a ratio of as much as 8:1 by the installation of such protective devices.

What's New in Tubes?

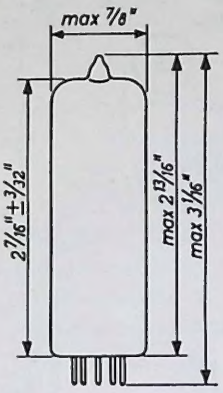
Products mentioned in the series "What's New in Tubes?" are available through Rogers distributors across Canada. Complete data sheets or further information may be obtained by writing direct to Rogers Electronic Tubes and Components, Technical Information Service, 116 Vanderhoof Avenue, Toronto 17, Ont.

Rogers 6CW5 — The present day sound output stage uses an output transformer to match the high impedance of the sound output tube to the low impedance speaker voice coil. As an example, type 6AQ5 requires a load impedance of about 5000 ohms, as shown in most tube manuals while speaker voice coil impedances run about 3 ohms. From theory, a step down transformer, having a turns ratio equal to the square root of 5000 divided by 3, is required. In medium and high quality receivers this transformer adds significantly to the cost and is the major cause of distortion. Thus many attempts have been made in the past to eliminate the step down transformer and feed the speaker voice coil directly from the output tubes.

The 6CW5 is a tube which solves this problem. The circuit and operating characteristics below show an output of 5.9 watts for 2.85 volts rms input. More explicitly 5.9 watts is the total output obtained for an input consisting of 2 sine voltages, both equal in amplitude to 2.85 volts rms, but differing in frequency. This rating more closely simulates reproduction



TUBE OUTLINE



BOTTOM VIEW OF BASE

1. Internally connected
2. Grid No. 1
3. Cathode, grid No. 3
4. Heater
5. Heater
6. Internally connected
7. Plate
8. Internally connected
9. Grid No. 2

Operating Characteristics:

Single-ended push-pull; 2 tubes, 2 semi voltage input.

Supply voltage	300 V dc
Load resistance, Rp	1000 ohms
Zero signal cathode current	69 mA dc
Input A.F. voltage for each frequency separately	2.85 V rms
Max. signal cathode current	67 mA dc
Max. power output	5.9 watts
Total harmonic distortion at max. power output	8.5 percent

Heater data: 6.3 volts at 0.76 amperes per tube.

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of music and speech than the conventional single frequency power output rating.

From the schematic the two tubes are seen to be in series D.C.-wise, as the current through the upper tube flows also through the lower. A.C.-wise the lower tube is a grounded-cathode audio output amplifier with the load (120 ohms plus 8 ufd plus 1000 ohms speaker voice coil in series) in the plate circuit. The upper tube has for an input the drop across the 120 ohm resistor in the plate circuit of the lower tube and operates essentially as a cathode follower feeding the same load. A.C.-wise the load sees the two tubes in

TIPS FOR TECHNICIANS

Testing Dry-Disc Rectifiers — The tester I have constructed will check all sizes of rectifiers from those used in portables to the much larger ones used in TV sets. It was built from old parts on hand, the first item being a large push-pull output transformer that develops a secondary voltage of about 7 when the primary is connected to the 115 volt a-c line. The second item is an a-c voltmeter with a full-scale reading of 3 volts. The one I used was the type employed in early receivers to indicate when proper heater voltage was applied to the tubes, the dial being divided into yellow and red sections. The meter and rectifier to be tested are connected in series across the secondary of the transformer. The load on the transformer is such that, when testing a perfect 400 to 450 ma. rectifier, the meter deflection will be approximately full-scale. If the rectifier has become aged or is otherwise defective, the deflection will approach mid-scale. The smallest rectifiers used in portables will give a deflection of about 2 volts if in satisfactory condition.

J. M. WALLACE, Toronto, Ont.

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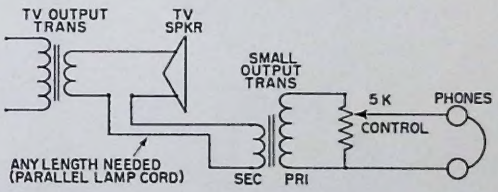
parallel. Thus for optimum matching a lower resistor load will suffice. The circuit shows a load of 1000 ohms but this is not critical and a 800 ohm or two 400 ohm speakers in series work well. Such speakers are, or will shortly be, available through distributors selling Rogers electronic tubes.

This tube and associated circuitry has been extensively used in Europe meeting unqualified success. It has also been used by a prominent manufacturer in Canada, promoted under the name "Bi-amply". Its acceptance was favourable and usage is spreading. Rogers 6CW5 is identical in all respects to the European EL86.

Forceps Have Many Uses — We use a pair of bent-nose forceps with locking lugs on nearly every service job. They have a thousand uses and help supply some of the extra hands that we always seem to need. For dial drives, making temporary connections of suspected parts, holding parts in tight corners, etc., they are indispensible. We obtained ours free from the family doctor.

J. A. WEBB, Peterborough, Ont.

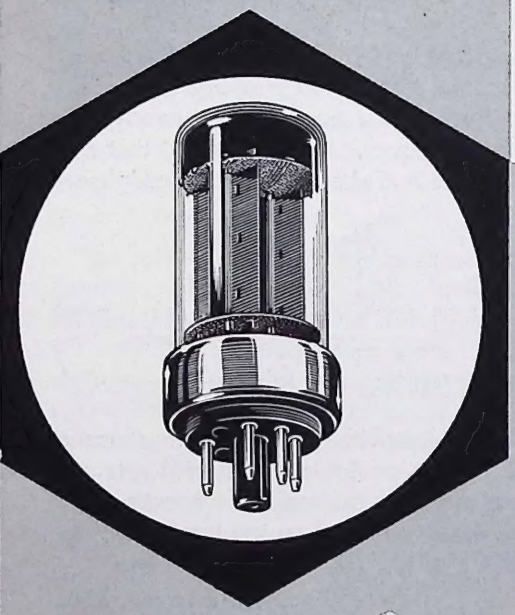
TV Sound for the Hard-of-Hearing —We have had a number of requests to install headphones on TV sets for the hard-of-hearing and think that others might benefit from our experience. There are several ways in which phones may be connected and low-impedance phones are available that would simplify the set-up. However, these are rather expensive for some customers. An arrangement that permits the use of cheap 2000 ohm headphones



is shown herewith. Old output transformers are usually available in salvaged sets and we find that this series connection has practically no effect on the tone quality or volume of the TV speaker.

PETER KUSHNIR, Brandon, Man.

$5 Send us your latest original service hint. If previously unpublished and found suitable for publication, you will receive a cheque for $5.00.



Rogers 5AR4 Special Quality° general purpose rectifier is a universal replacement for numerous commonly used 5 volt rectifiers. Designed for efficiency and long life, the 5AR4 is of pressed glass base construction. Other features of the tube include a 5 volt 1.9 amp. heater; a peak inverse voltage of 1500 and a maximum r.m.s. current output of 250 mA. The 5AR4 has a low voltage drop ensuring maximum output. Write for full details on this special quality rectifier.

°*Rogers Special Quality tubes are finding more and more applications in all types of electronic equipment. For greater reliability and lower maintenance costs, specify Rogers tubes.*

ROGERS

electronic tubes & components

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★ Rogers Electronic Tubes are sold through Canada's Independent Electronic Parts Distributors